4 December 1962

MEMORANDUM FOR: Chief, Plans and Development Staff

THROUGH : Executive Secretary, TDC

SUBJECT : Staff Study of Proposal Titled "Feasibility Study of an Ultra-High Resolution Viewer", NPIC #151/63

PROBLEM

1. There exists a need for applied research before a true virtual (aerial) image viewer with a large aperture can be constructed.

FACTS BEARING ON THE PROBLEM

2. Facts.

a. The microscope is a virtual image* viewing device. After a period of continued use of a microscope the fatigue factor of the individual using the instrument builds up rapidly due to the eye strain and physically bending over the instrument.

b. For reasonable magnifications, 10X and greater, it can be shown that a virtual image viewer is aperture limited. The eye relief of the microscope ocular can be larger than the pupil of the eye but is still limited by the pupil because of the necessary close proximity of the eye to the ocular. Any smaller aperture is very difficult to use because the eye must be positioned very accurately over the aperture.

c. A method for increasing the exit pupil of the viewing instrument would be a significant step in achieving an instrument with a suitable area of image viewing, 8 X 10 inches or larger instead of the conventional eyepiece of the microscope.

3. Assumptions

It appears to be a reasonable assumption that if a method could be devised to form a "multitude" of adjoining small apertures by either very small prisms or crossed diffraction gratings the aperture limit could be overcome and the area of image viewing could approach and exceed the 8 X 10 inches.

4. Definitions

* A virtual or aerial image is not formed physically but is formed when viewed in this case in its magnified state, on the retina of the eye itself.

DISCUSSION

5. The most logical approach appears to be the crossed diffraction grating. Gratings of the size and quality required are a state of the art and are not extraordinarily expensive.

6. A study, and breadboard proving and demonstrating feasibility is in order before a finalized piece of hardware would be undertaken.

CONCLUSION

7. To ascertain feasibility it will be necessary to perform a reasonable amount of applied research and construct hardware for analysis and demonstration purposes.

RECOMMENDATIONS

8. It is recommended that an [ ] contract be negotiated with [ ] as per letter dated 13 November 1962. The grating idea is proprietary with this company and it is therefore necessary to negotiate a sole source contract. 25X1A 25X1A

9. The cost stated, CPFF amount, Phase I, [ ] and Phase II, [ ] is greater than originally estimated in the initial proposal and is only for the Ultra-High Resolution Diffraction Viewer. Since the original proposal was submitted, more investigation has been conducted by the vendor, particularly on the materials and subcontracting, thus revising the costing to an amount considered to be a more realistic figure. 25X1A 25X1A

10. The subcontractor, [ ] is considered to be a capable and highly qualified organization. 25X1A

11. Phasing the contract is important. Should the results of the study as reported in Phase I fall short of expectations the work could be terminated without further expenditure.

12. So far as is known no parallel efforts in this type of development are or has been conducted.

[ ] 25X1A

Development Branch, P&DS